PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
Crawford, Andrew B.
A A THORNTON & CO
235 High Holborn
London WC1V 7LE
GRANDE BRETAGNE

28 FEB 2002
ABC

PCT

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence and Administrative Instructions, Section 601(a))

Applicant's or agent's file reference: ABC/20093	Date of mailing (day/month/year): 26.02.02
	IMPORTANT NOTIFICATION

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/GB 01/03124	11/07/2001	11/07/2000

Applicant: MICROGENIX LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

06/02/2002

2. This date of receipt is:

- [x] the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
- [ ] the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
- [ ] the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. [ ] **ATTENTION:** That date of receipt is **AFTER** the expiration of 19 months from the priority date. Consequently, the election(s) made in the demand does (do) not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)). Therefore, the acts for entry into the national phase must be performed within 20 months from the priority date (or later in some Offices) (Article 22). For details, see the *PCT Applicant's Guide*, Volume II.

[ ] *(If applicable)* This notification confirms the information given by telephone, facsimile transmission or in person on: _____

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	KENNEDY M B Tel. (+49-89) 2399-2976

EUROPÄISCHES PATENTAMT · EUROPEAN PATENT OFFICE · OFFICE EUROPÉEN DES BREVETS

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61L9/20 F24F3/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61L F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 757 495 A (SIEVERS W) 11 September 1973 (1973-09-11) claims	1-10
A	US 3 846 072 A (PATTERSON L) 5 November 1974 (1974-11-05) page 1, line 31 - line 33; claims	1-10
A	GB 2 215 234 A (FORWARD TEAM 8 PRIVATE LIMITED) 20 September 1989 (1989-09-20) claims; figure 3	1-10
A	US 5 225 167 A (WETZEL LAWRENCE E) 6 July 1993 (1993-07-06) claims; figure 1	1-10

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 November 2001	28/11/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	ESPINOSA, M

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 112 370 A (GAZZANO MICHELE) 12 May 1992 (1992-05-12) claims	1-10
A	WO 92 20974 A (VERTRON INTERNATIONAL PTY LIMI) 26 November 1992 (1992-11-26) claims	1,3,5,6, 8,10
A	GB 2 212 370 A (ONG TIONG EE) 19 July 1989 (1989-07-19) claims	1,2,5-7, 10

ormation on patent family members

Inte nal Application No
PC1/GB 01/03124

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 3757495	A	11-09-1973	NONE		
US 3846072	A	05-11-1974	CA	1009822 A1	10-05-1977
GB 2215234	A	20-09-1989	HK	163096 A	13-09-1996
			SG	90992 G	04-12-1992
US 5225167	A	06-07-1993	DE	69200471 D1	03-11-1994
			DE	550366 T1	31-03-1994
			EP	0550366 A2	07-07-1993
			ES	2048692 T1	01-04-1994
US 5112370	A	12-05-1992	IT	1248429 B	16-01-1995
WO 9220974	A	26-11-1992	AU	658628 B2	27-04-1995
			WO	9220974 A1	26-11-1992
GB 2212370	A	19-07-1989	NONE		

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 January 2002 (17.01.2002)

PCT

(10) International Publication Number
WO 02/04036 A1

(51) International Patent Classification⁷: A61L 9/20, F24F 3/16

(21) International Application Number: PCT/GB01/03124

(22) International Filing Date: 11 July 2001 (11.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0017058.9 11 July 2000 (11.07.2000) GB

(71) Applicant *(for all designated States except US)*: **MICROGENIX LIMITED** [GB/GB]; Water House, Thames Road, Crayford, Kent DA1 4TF (GB).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **HALL, Philip** [GB/GB]; c/o Microgenix Limited, Water House, Thames Road, Crayford, Kent DA1 4TF (GB).

(74) Agent: **ANDREW, B., Crawford**; A A Thornton & Co., 235 High Holborn, London WC1V 7LE (GB).

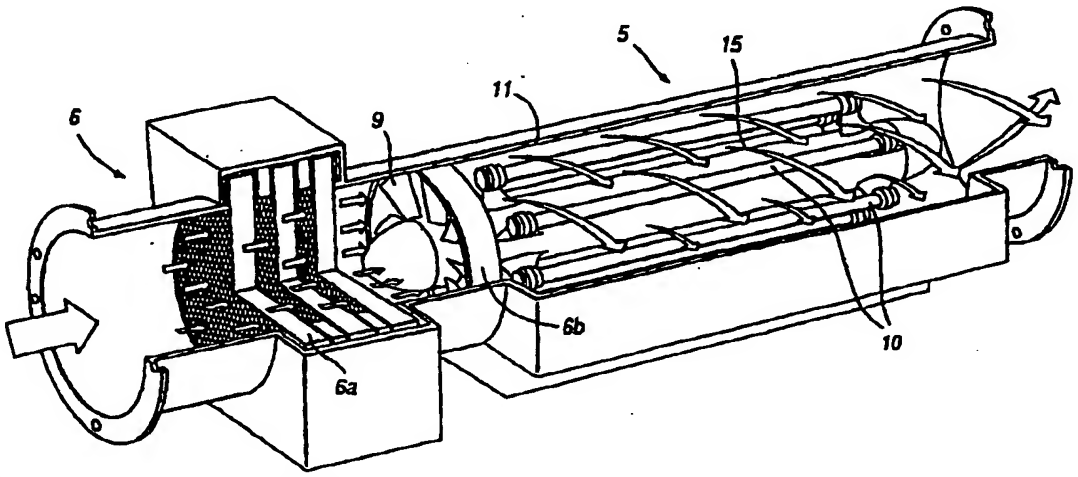
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PURIFICATION OF AIR



(57) Abstract: An air purification system for purifying recirculated air eg in an aircraft, vehicle, offices or hospitals comprises the combination of a filter section with an ultraviolet illumination section and a coating of an antimicrobial agent on surfaces in one or both of the filter and illumination sections. Air flow through the illumination section is caused to be slightly turbulent by means of a multi-bladed fan being fixed in position between the filter and illumination sections. This increases the dwell time of contaminants in the illumination section.

WO 02/04036 A1

Copy for the Elected Office (EO/US)

PCT/GB01/03124

PATENT COOPERATION TREATY

10/070921

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

ANDREW, B., Crawford
A A Thornton & Co.
235 High Holborn
London WC1V 7LE
United Kingdom

Date of mailing (day/month/year)
28 février 2003 (28.02.03)

Applicant's or agent's file reference
ABC/20093

IMPORTANT NOTIFICATION

International application No.
PCT/GB01/03124

International filing date (day/month/year)
11 juillet 2001 (11.07.01)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address

MICROGENIX LIMITED
Water House
Thames Road
Crayford
Kent DA1 4TF
United Kingdom

State of Nationality: GB
State of Residence: GB
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[X] the person [ ] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address

MICROGENIX TECHNOLOGIES LTD
Wolflands
High Street
Westerham
Kent TN16 1RQ
United Kingdom

State of Nationality: GB
State of Residence: GB
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

The applicant identified in Box 1 has assigned his rights to the applicant identified in Box 2, for the purposes of all designated States except the United States of America.

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

Carine SEVILLANO (Fax 022 338 87 40)

Telephone No. (41-22) 338 9254

Form PCT/IB/306 (March 1994)

005489674

PATENT COOPERATION TREATY

PCT

15 MAR 2002

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference ABC/20093	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB 01/ 03124	International filing date *(day/month/year)* 11/07/2001	Priority date *(day/month/year)* 11/07/2000
International Patent Classification (IPC) or national classification and IPC A61L9/20		
Applicant MICROGENIX LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 2 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consists of a total of _____ sheets.

3. This report contains indications relating to the following items:

I ☒ Basis of the report

II ☐ Priority

III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

IV ☐ Lack of unity of invention

V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

VI ☐ Certain documents cited

VII ☐ Certain defects in the international application

VIII ☐ Certain observations on the international application

Date of submission of the demand 06/02/2002	Date of completion of this report 08/03/2002
Name and mailing address of the IPEA/ European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	Authorized officer FLETCHER A S Tel. (+49-89) 2399 2828

EUROPÄISCHES PATENTAMT · EUROPEAN PATENT OFFICE · OFFICE EUROPÉEN DES BREVETS

Form PCT/IPEA/409 (cover sheet) (July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Internation application No. PCT/ GB 01/ 03124

I. Basis of report

1. The basis of international preliminary examination report is the application as originally filed.

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

2. The question of whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable has not been and will not be the subject of the international preliminary examination (Article 34 (4) (a) (i) (ii) PCT; see also international search report) in respect of:

2.1 Applications having an unnecessary plurality of independent claims (generally not more than 1 independent claim in the same category is necessary; Article 6 PCT);

2.2 unsearched subject-matter (Article 17 (2) (a), Rule 66.1 (e) PCT).

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

3. To the extent that the international preliminary examination has been carried out (see item III above), the following is pointed out (Article 35 (2) and (3) (b) and Rule 70.7 and 70.8 (ii) PCT):

In light of the documents cited in the international search report, it is considered that the invention as claimed in the independent claims meets the criteria mentioned in Article 33 (1) PCT, i.e. it appears to be novel, to involve an inventive step and to be industrially applicable.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
ABC/20093		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 01/03124	11/07/2001	11/07/2000
Applicant		
MICROGENIX LIMITED		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

[ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

[ ] contained in the international application in written form.

[ ] filed together with the international application in computer readable form.

[ ] furnished subsequently to this Authority in written form.

[ ] furnished subsequently to this Authority in computer readble form.

[ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

[X] the text is approved as submitted by the applicant.

[ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

[X] the text is approved as submitted by the applicant.

[ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

[ ] as suggested by the applicant.

[X] because the applicant failed to suggest a figure.

[ ] because this figure better characterizes the invention.

[ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/03124

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61L9/20 F24F3/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61L F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 757 495 A (SIEVERS W) 11 September 1973 (1973-09-11) claims ---	1-10
A	US 3 846 072 A (PATTERSON L) 5 November 1974 (1974-11-05) page 1, line 31 - line 33; claims ---	1-10
A	GB 2 215 234 A (FORWARD TEAM 8 PRIVATE LIMITED) 20 September 1989 (1989-09-20) claims; figure 3 ---	1-10
A	US 5 225 167 A (WETZEL LAWRENCE E) 6 July 1993 (1993-07-06) claims; figure 1 --- -/--	1-10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 November 2001	28/11/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	ESPINOSA, M

3

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/03124

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 112 370 A (GAZZANO MICHELE) 12 May 1992 (1992-05-12) claims	1-10
A	WO 92 20974 A (VERTRON INTERNATIONAL PTY LIMI) 26 November 1992 (1992-11-26) claims	1,3,5,6, 8,10
A	GB 2 212 370 A (ONG TIONG EE) 19 July 1989 (1989-07-19) claims	1,2,5-7, 10

3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 01/03124

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3757495 A	11-09-1973	NONE	
US 3846072 A	05-11-1974	CA 1009822 A1	10-05-1977
GB 2215234 A	20-09-1989	HK 163096 A	13-09-1996
		SG 90992 G	04-12-1992
US 5225167 A	06-07-1993	DE 69200471 D1	03-11-1994
		DE 550366 T1	31-03-1994
		EP 0550366 A2	07-07-1993
		ES 2048692 T1	01-04-1994
US 5112370 A	12-05-1992	IT 1248429 B	16-01-1995
WO 9220974 A	26-11-1992	AU 658628 B2	27-04-1995
		WO 9220974 A1	26-11-1992
GB 2212370 A	19-07-1989	NONE	

PURIFICATION OF AIR

The present invention relates to a method and apparatus for purifying air.

The purification of air is a long standing problem and the problems are increased when recirculated air is being utilised as occurs in many enclosed spaces such as ships, vehicles, offices, aircraft and hospitals. There have been many attempts to improve the purification of air generally and one such system is disclosed in US Patent No 4,017,736 which discloses an air purification system utilising a pre-filter metal mesh and sub-micron laminar flow cell to remove particles and high intensity ultraviolet generator to kill microorganisms as air is forced by a fan through a shielded enclosure. This previous arrangement is designed to a free standing unit in an open area, and is not disclosed as being suitable for use with recirculated air.

There are particular problems with purifying air for recirculation in enclosed spaces and particularly in ships, offices, aircraft and hospitals. Up to now, filtering the air has been the preferred method of air purification but this has been shown to be either inadequate or else energy inefficient.

The present invention proposes a recirculatory air system which includes within its ducting the provision of an ultraviolet radiation emission section which is arranged to purify the air in combination with an antimicrobial coating.

Preferably, the ultraviolet radiation emission section is arranged to be maintained in situ and is provided with one or more openable inspection panels provided with means which automatically terminate energisation of the ultraviolet light source upon opening the or each panel.

Additionally, it is preferred to control the ultraviolet light source in such a manner that ozone is not produced but, if necessary, ozone filters can be included.

In order that the present invention be more readily understood, an embodiment thereof will now be described with reference to the accompanying drawings, in which:-

Figure 1 shows a diagrammatic representation of an installation according to the present invention;

Figure 2 shows a diagrammatic side view of a portion of the installation shown in Figure 1;

Figure 3 shows a diagrammatic representation of a control box used in the installation shown in Figure 1.

Referring now to Figure 1, this shows diagrammatically a recirculating air system for purifying air in an aircraft. This is but one application of the present invention and it is suitable for use in any situation where recirculated air is being utilised eg in a ship, motor vehicle, clean room or in offices and hospitals. The enclosed space 1 is provided with an air extraction vent 2 which permits air to be withdrawn from the enclosed space 1 under action of a fan system 3 via ducting 4. Located at a suitable position along the length of the ducting 4 is an ultraviolet illumination section 5 which will be described in detail below. Additionally, if required, an air flow conditioning section 6 is also provided in the ducting 4 which is arranged to provide conventional mechanical filtering of the air flowing through the ducting 4. The thus cleaned air is returned to the enclosed space via an air inlet 8 and the operation of the fan system 3 and the ultraviolet illumination section 5 is monitored and/or controlled by a control unit 7.

As mentioned above, air extracted from the enclosed space is drawn through the air flow conditioning section 6 which is shown in more detail in Figure 2 in combination with the ultraviolet illumination section 5. The section 6 can include one or more filter sections 6a and a pre-sterilisation section 6b. The filters used can be one or more of the conventional mechanical filters such as an activated charcoal filter as well as an electrostatic filter. It is important that the

filters do not create a back pressure of any significance in the system and we have found a filter of 5 microns (G4/EU4 rating) to be sufficient. The pre-sterilisation section 6b includes an arrangement for creating slightly turbulent air flow through the ultraviolet illumination section 5. This can be achieved in a number of ways but we prefer to utilise a fixed multi bladed directional fan 9. Alternatively, the fan may be replaced by fixed shaped or planar members may be provided at an angle to the air flow in order to provide a sinous air flow path through the section 5. The fixed shaped or planar members may be perforated or made of a porous material.

The ultraviolet illumination section 5 will now be described and is shown as being of circular cross section but it will be appreciated that any convenient cross section may be utilised which may or may not be the same cross section as used for the ducting 4. The section 5 has a cylindrical side wall 11 which encloses a central core 15 around which are mounted the individual light sources 10. The number and length of the sources 10 will depend on the air flow conditions but in the present embodiment we prefer to have eight light sources 10 uniformly disposed around the core 15 and the effect of this is to cause slightly turbulent air flow in the annular space between the core 15 and the cylindrical side wall 11. The light sources 10 are held in position such that they are spaced from the core 15 which maximises the effect of the ultraviolet light on the bacteria in the air as the air flow passes over substantially all the surface of the sources 10.

The surfaces of the wall 11 and the central core 15 are either made of or coated with material with a high reflectance to UV light. We prefer to use polished aluminium sheet which has been found to be better than polished stainless steel. The side walls 11, can be provided with an operable panel to permit maintenance of the light sources 10 and permit other access to the illumination section 5. The individual light sources 10 are attached to the core 15 in any convenient manner and are most conveniently attached by means of simple clips. Additionally, the panel in the side wall 11 may be provided with detectors (not

shown) which will detect the opening or potential opening of a panel and thus signal to the control unit 7 that the light sources 10 should be switched off. This avoids possible eye damage to maintenance personnel. The exact way in which the potential opening of the panels is signalled to the control unit is a matter of design choice and could be a micro switch or other suitable sensor which could be activated by the operation of a latch or the like on the side wall which is required to be unlatched prior to the movement of the panel itself.

Figure 3 shows a typical front panel 19 for the control unit 7 where an isolator switch 20 is shown. The control unit can be located at any convenient position but will usually be remote from the fan system 3 and illumination section 5. A key pad 21 can provide control of the illumination section 5 and also of fan speed to cater for different conditions and an LFI and hours run meter 22 is also provided which can be checked by maintenance personnel.

The proposed method is to use the ultraviolet light within the illumination section 5 in such a manner as to provide an excess of a 99% sanitation rate overall. It is also proposed to recirculate the air at regular intervals in order to improve the sanitation rate.

We have also found it to be advantageous to coat the internal surfaces of the pre-sterilisation section 6b and/or the filter section 6a with an antimicrobial agent. Preferably the agent is one which is non-leaching and non-volatile and is not consumed by microorganisms. One suitable agent is a standard antimicrobial substance (a quaternary amine) in a silane which when coated on a surface bonds to the surface to render it antimicrobially active. In particular, an agent incorporating 3-(trimethoxysilyl)-propyldimethyloctadecyl ammonium chloride as active ingredient as sold by Aegis Environments of Midland, Michigan, USA under the trade mark Aegis Microbe Shield is particularly useful.

When using an antimicrobial agent, it is preferred to use a metal "wool" as the filter in the filter section 6a and this is usually of stainless steel or other non-corroding metal. However, other filter materials such as natural or

synthetic fibres or mixtures thereof could be used.

Alternatively, or in addition, we have found it advantageous to coat the internal surfaces of the ultra-violet illumination section with the microbial agent.

Although the apparatus described above can be assembled from discrete parts or modules, it is preferred to construct the conditioning section 6 and the UV treatment section 5 as a unit so that the unit can be readily fitted into existing ducting.

By using a three stage purification process, filtration, antimicrobial treatment and UV treatment it is possible to readily achieve a sanitation rate of in excess of 99% when recirculating the air.

CLAIMS:

1. A method of purifying air comprising withdrawing air from an enclosed space, passing the withdrawn air over surfaces coated with an antimicrobial agent, through an ultraviolet radiation and returning the thus irradiated air to the enclosed space.

2. A method according to claim 1, and comprising filtering the withdrawn air.

3. A method according to claim 1 or 2, and comprising causing turbulence to the air flow prior to passing the withdrawn air through ultraviolet radiation.

4. A method according to claim 1, 2 or 3, wherein the agent is an antimicrobial substance in a silane.

5. A method of purifying air substantially as hereinbefore described with reference to the accompanying drawings.

6. Apparatus for purifying air comprising means (3) for withdrawing air from an enclosed space (1), ducting (4) for directing withdrawn air through a unit including an ultraviolet radiation section (5) for irradiating the withdrawn air and thence back to an air inlet (8) arranged to communicate with the enclosed space, the unit having at least one of its internal surfaces coated with an antimicrobial agent.

7. Apparatus according to claim 6, and comprising a filter (6a) for filtering the withdrawn air.

8. Apparatus according to claim 6 or 7, and comprising means (6b) for causing the air flow to separate into a number of various paths in order to cause turbulence in the air flow.

9. Apparatus according to claim 7 or 8 wherein the antimicrobial agent is coated on at least some of the internal surfaces of the filter (6a) and/or the air flow separating means (6b).

10. Apparatus for purifying air substantially as hereinbefore describes with reference to the accompanying drawings.

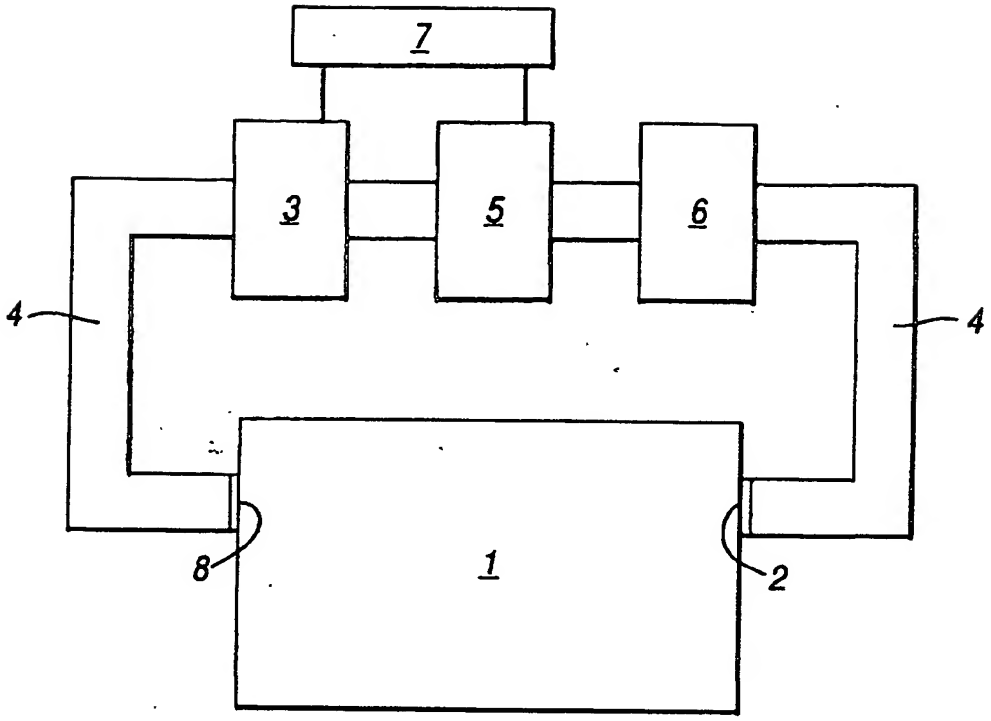


Fig.1

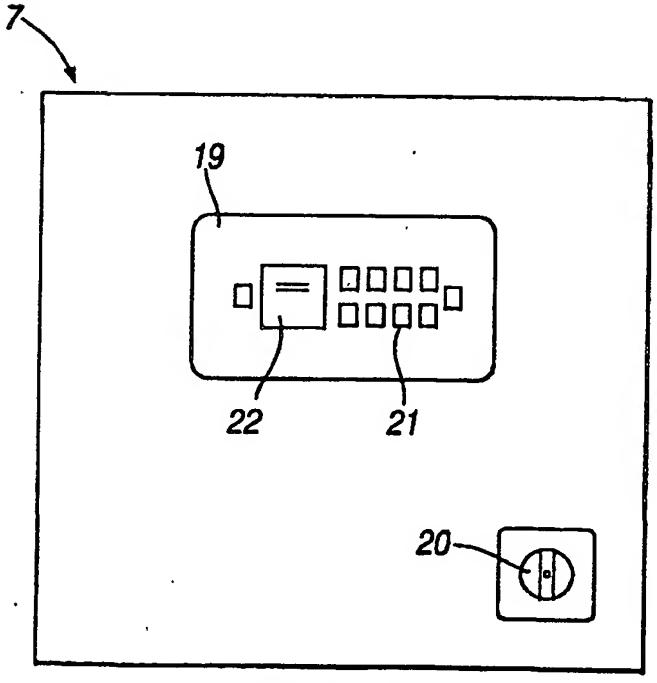


Fig.3

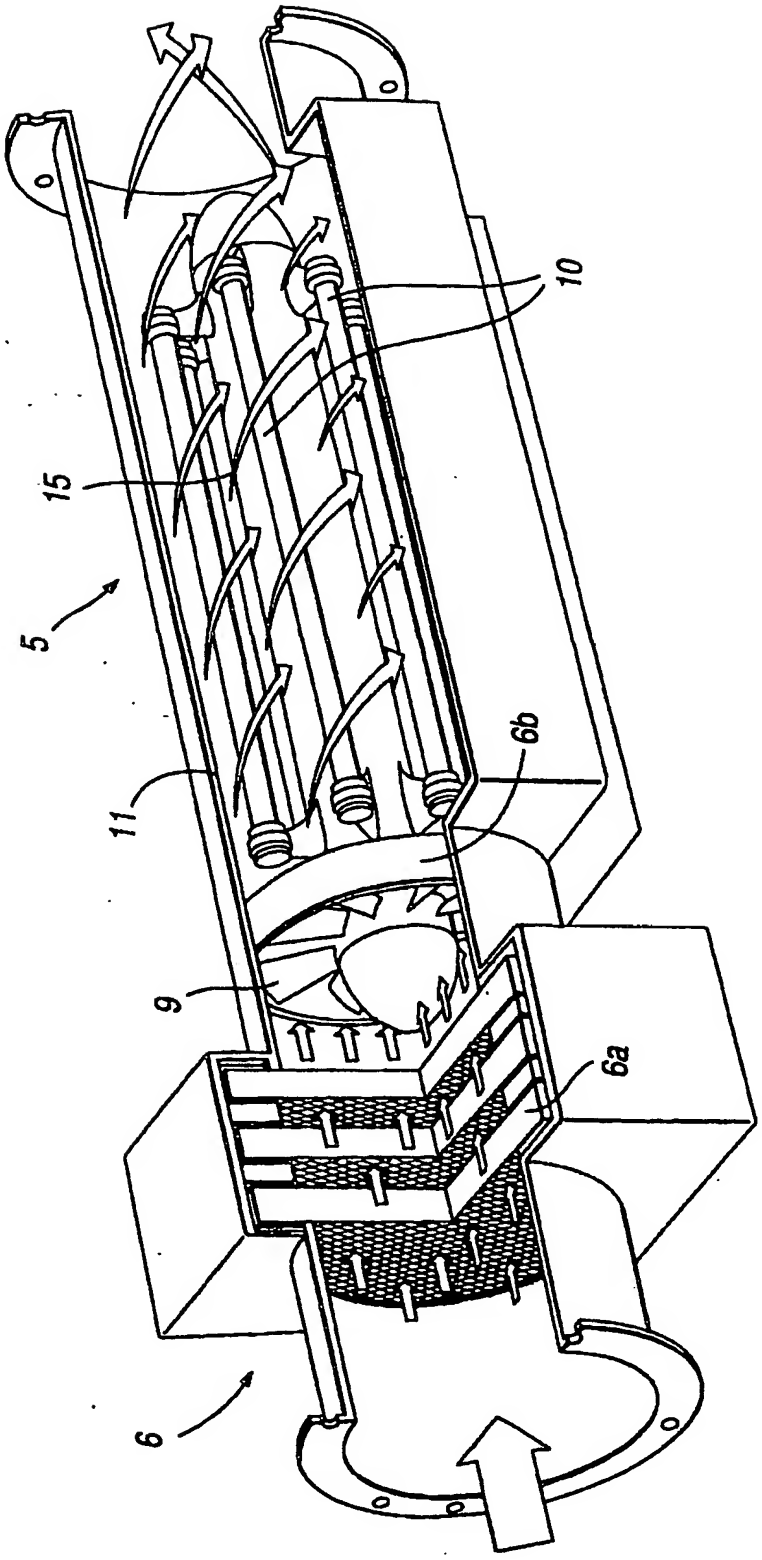


Fig.2

INTERNATIONAL SEARCH REPORT

Inte[illegible]onal Application No
PCT/GB 01/03124

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61L9/20 F24F3/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61L F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 757 495 A (SIEVERS W) 11 September 1973 (1973-09-11) claims	1-10
A	US 3 846 072 A (PATTERSON L) 5 November 1974 (1974-11-05) page 1, line 31 - line 33; claims	1-10
A	GB 2 215 234 A (FORWARD TEAM 8 PRIVATE LIMITED) 20 September 1989 (1989-09-20) claims; figure 3	1-10
A	US 5 225 167 A (WETZEL LAWRENCE E) 6 July 1993 (1993-07-06) claims; figure 1	1-10

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 November 2001	28/11/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	ESPINOSA, M

INTERNATIONAL SEARCH REPORT

Inte[illegible]nal Application No
PCT/GB 01/03124

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 112 370 A (GAZZANO MICHELE) 12 May 1992 (1992-05-12) claims	1-10
A	WO 92 20974 A (VERTRON INTERNATIONAL PTY LIMI) 26 November 1992 (1992-11-26) claims	1,3,5,6, 8,10
A	GB 2 212 370 A (ONG TIONG EE) 19 July 1989 (1989-07-19) claims	1,2,5-7, 10

INTERNATIONAL SEARCH REPORT

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Inte nal Application No
PC1/GB 01/03124

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